Remarks

The present amendment is responsive to the Office Action mailed in the above-referenced case on July 31, 2002. Claims 1-23 are presented for examination. Claims 1-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Lakshman et al. (ACM 1-58113-003), hereinafter Lakshman.

Applicant has carefully reviewed the prior art of Lakshman, and the Examiner's rejections and statements. Applicant herein presents argument to more particularly point out the subject matter regarded as the invention, and to establish that the claims distinguish unarguably over the prior art presented. Applicant points out and argues the key limitations in the base claims that the Examiner appears to have misunderstood in his rejection and statements.

Regarding claim 1, the Examiner states that Lakshman anticipates a first set of rules associating to the packets by values of the header fields, (Lakshman, p. 203, col. 2, lines 29-35). Applicant has carefully reviewed the portion of Lakshman and argues that the portion only describes that the packet filtering mechanism should parse a large portion of the packet header before a forwarding decision is made, resulting in the incoming packet being classified using a set of predefined rules. There is clearly nothing whatsoever in the teaching given in the portion that teaches association of specific header values to specific rules, as in applicant's claim.

The Examiner further states that Lakshman numbers intervals between break points in sequential binary numbers (as the applicant clearly claims), associates a subset of the first set of rules as applicable in each interval between break points on each axis, then considers a packet as a point in the N-dimensional space according to its header field values, locates the binary numbered interval into which the point projects on each

axis by performing a search on each axis for the numbered interval into which the point projects on that axis, thereby determining rules applicable to the packet for that axis, and then determines the specific rules applicable to the packet from the subsets of rules by selecting those rules as applicable to the packet that apply to the packet on all of the N axes. The Examiner further notes that a set of break points constitutes an interval.

Applicant has carefully studied the portion of Lakshman (p. 208, col. 2, lines 10-34) cited and applied by the Examiner in support of the above statement. Applicant respectfully traverses the Examiner's above statement, and argues that Lakshman does not number intervals between break points in sequential binary numbers at all, and there is no teaching whatsoever in the above portion of Lakshman cited by the Examiner, or anywhere else in the teaching of Lakshman, of naming the intervals by numbering them in sequential binary numbers.

Now referring to Fig. 2 of Lakshman, and the description given in the portion of Lakshman above cited and applied by the Examiner, applicant argues that the illustration and description given of the functioning of the algorithm of Lakshman clearly does not read on all of applicant's limitations in the base claims. The rules are represented in Fig. 2 of Lakshman by two-dimensional rectangles that can be arbitrarily overlapped. The first step, or pre-processing step, of the algorithm projects the edges of the rectangles to the corresponding axis, the rectangles creating seven intervals in each axis. In the worst case the projection results in a maximum of 2n +1 intervals on each dimension. An N-dimensional bitmap is associated with each interval, and a bit in the bitmap is set only if the corresponding rectangle overlaps with the interval that the bitmap corresponds to. The packet, represented in Fig. 2 by point P1 arrives to the system, and during the first online step the intervals in both axis that contain this point are located. In the second step

the bitmaps are used to locate the highest priority rectangle that covers point P1. After the logical-AND of the bitmaps, the first bit that is set in the resulting bitmap is that corresponding to rule 3, as shown in the Fig., which is the highest priority of rule, amongst all those overlapping point P1.

Applicant now wishes to direct the Examiner's attention to applicant's Fig. 3, wherein a representation is illustrated of rules projected on an X-axis and a Y-axis, and a packet in process is represented by point X in the two-dimensional space, similarly to Fig. 2 of Lakshman. The point X is located by the field values for fields A and B, and, as in Lakshman, has been acquired by the system for the purpose of determining the rule which is to be used to process the packet. The upper and lower field value boundaries for each rule in this simple example are projected onto each axis, creating a series of break points on each axis, the break points establishing a series of intervals on each axis, also similarly to Fig. 2 of Lakshman.

Although only two fields, thus two dimensions, are used in the examples of applicant's Fig. 3 and also for Fig. 2 of Lakshman, it is noted that a packet may be represented by a point in N-dimensional space, such as in as many as five dimensions for Internet protocol version 4 (IPv4), and, as recognized by the skilled artisan, determining the applicable rule or rules in such a system of conventional art can become exponentially complicated. Parallel binary searches are typically performed to determine the interval on each axis within which a projection of the point falls.

Applicant's invention, however, provides advantages over the prior art in that, a unique contribution of a preferred embodiment of the present invention is in determining the best break points and methods to accomplish the search in the least number of steps. There are a number of ways in which one may select among the break points and conduct the search. One inefficient example of such a method is selecting among the existing break

points without preference, comparing the selected break point value with the packet point projection, yielding where the point lies relative to the selected break point. Referring to applicant's Fig. 3, consider, for example, a first step on the X-axis using the break point 1C. A compare will show that the point 05 lies to the left of 1C, eliminating the interval from 1C to 1F. One may then select any one of the break points between 01 and 1C , and continue to process, eventually isolating the correct interval. Another possibility, again with reference to applicant's Fig. 3, is to select break points considering the binary value of the break points, at a point that where the most significant bit of the X-value changes. In the example shown in applicant's Fig. 3, 0E is 01110 and 17 is 10111. In this scheme one would select 17 as the first break point, and the search continues by selecting break points on the axes were the second bit changes, the third bit changes, and so on the fifth bit.

The present inventors, however, have determined an improved process for determining the best break points and accomplishing the search in the least number of steps, electing to name the intervals by numbering them sequentially in binary, selecting the break points by the sequentially numbered intervals. Applicant now wishes direct the Examiner's attention to applicant's Fig. 2, wherein a table is illustrated which has been created for the intervals on the two axes, as in the example shown in applicant's Fig. 1. In the left most column of the table interval break points are shown, corresponding to the X-axis and Y-axis of applicant's Fig. 1, the interval break points being the end points for each interval. Binary numbers in ascending order from 0 are shown for each axis in the middle column of the table of Fig. 2. The intervals are numbered to provide, in a preferred embodiment of present invention, a unique way for structuring the process of determining into which interval a header value for a packet in process

falls. The right most column in the table of Fig. 2 is the bitmap for the interval, which relates the rules that apply for that interval. As an example, again referring to applicant's Fig. 1, in the case of in interval number 001, from 0 to break point 01, the bitmap is 000, as no rule projects on the X-axis in this interval. The skilled artisan will be able to follow the break points, interval ordering and bitmaps for the rest of the X-axis and for the Y-Axis of Fig. 2 in this example.

The above scheme has a distinct advantage over systems of conventional art in that there are only three bits in the sequential interval numbers (in the example presented) rather than 5 bits to deal with in the axis values, as in Lakshman, requiring fewer steps and less hardware implementation for determining the best break points when compared to examples as described above for conventional art. In the embodiment of the present invention described in step-by-step progress in applicant's specification beginning on page 12, line 23, as each packet arrives to be processed in the packet-by-packet phase, the several steps are performed and the best rule is selected for that packet, then another packet is processed. If the rules change, the mapping of the rules to axes has to change as well (pre-processing phase) before further packets may be processed. Tables for multiple rule sets may be stored, and the correct table selected when rules change.

Upon carefully and thorough review of Lakshman, particularly the portions cited and applied by the Examiner to suuport the Examiner's rejections of applicant's claims, applicant is confident that nowhere in a reference of Lakshman is there any disclosure, suggestion or intimation of anything having to do with naming intervals by numbering intervals between break points in sequential binary numbers, or locating the binary numbered interval into which the point projects on each axis by performing

a search on each axis for the numbered interval, thereby determining rules applicable to the packet for that axis, as is specifically recited in applicant's base claims 1 and 12. Lakshman clearly utilizes the break points in all of the hardware implementation, using the actual header values to which a rule applies in all of the hardware computations. Applicant's invention, however, uses nothing of the actual header values, instead using the sequential binary numbering of intervals in the calculations.

Applicant therefore believes independent claims 1 and 12 are patentably distinct over the prior art presented by the Examiner. Dependent claims 2-11, and 13-22 are then patentable on their own merits, or at least as depended from a patentable claim.

Regarding applicant's independent claim 23, the Examiner's states in the instant Office Action that Lakshman anticipates conducting a first search on one or more axes, and using information from the first search to simplify further searching on remaining axes. Applicant has carefully reviewed page 209, col. 2, lines 56-62, and page 203, col. 2, lines 19-25 of Lakshman, and applicant can find no specific teaching or suggestion in either portion cited of simplifying a search comprising the steps of conducting a first search on one or more axes, and using information from the first search to simplify further searching on remaining axes, as is recited in applicant's claim 23. The teachings of the above portions of Lakshman actually have nothing to do whatsoever with the limitations of applicant's claim 23. Applicant therefore believes that claim 23 is also clearly patentable over Lakshman.

As all of the claims standing for examination as amended have been shown to be patentable over the art of record, applicant respectfully requests reconsideration and that the present case be passed quickly to issue. If any fees are due beyond fees paid with this amendment, authorization is made to

deduct those fees from deposit account 50-0534. If any time extension is needed beyond any extension requested with this amendment, such extension is hereby requested.

Marked-Up Version to Show Changes

There are no amendments to the claims or specification in the present response.

Respectfully Submitted,
Rodolfo Milito et al.

by______________________
Donald R. Boys
Reg. No. 35,074

Donald R. Boys
Central Coast Patent Agency
P.O. Box 187
Aromas, CA 95004
(831) 726-1457